Instrument: NOAA SP-2

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Instrument Description

The NOAA Single-Particle Soot Photometer (SP-2) utilizes laser-induced incandescence (LII) to measure soot (elemental carbon) particles in the upper troposphere and lower stratosphere. Ambient particles are introduced into the lasing cavity of an infrared YAG laser (see Figure 1). The intense laser light heats soot and other light-absorbing particles to the point of vaporization. When a particle reaches temperatures of greater than about 1000K, it begins to incandesce in the visible range (blackbody). Detection of wavelength-resolved emission provides critical information about a particle's vaporization temperature, which in turn constrains its chemical composition. Additionally, the emitted power can be used for particle sizing.

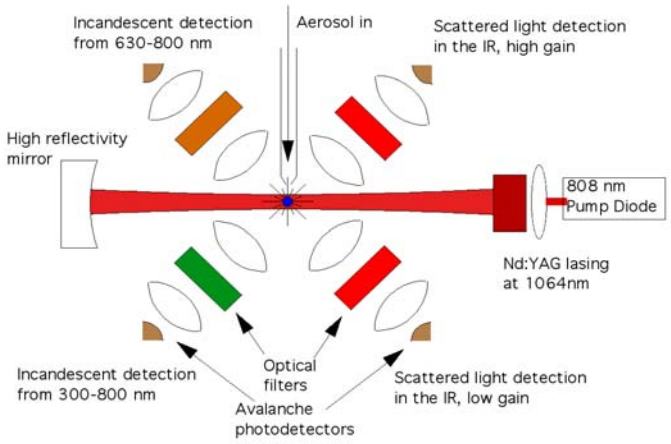

Figure 1. Schematic diagram of the SP-2 photometer showing the basic optics and laser-induced incandescence and scattering detectors.

Scattered light is measured to provide optical sizing information for non-light-absorbing particles. This signal may also constrain the scattering cross-section of soot-containing particles.

Instrument Performance

Particle type / size range		Size	Number concentration
Light-absorbing / 0.2 – 0.8 µm diameter	Precision*	30%	$\sqrt{N}^*$
	Accuracy	±40%	2-15%
Non-light-absorbing / 0.1 – 1µm diameter	Precision*	25%	$\sqrt{N}^*$
	Accuracy	±25-200%	2-20%

*N represents the number of particles detected, and depends on the ambient conditions.